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MAPS AND MAP-MAKING*

BY

CYRUS C. ADAMS

Map-makng is very old, and has been practised by the most primitive peoples for many ages. Rude scratches on many rocks in South America are now interpreted as maps. East Greenland natives carve maps out of wood; American Indians make map-sketches on birch and other barks; the Marshall Islanders charted the sailing routes along their coasts long before they knew of the white man; the desert nomad sketches maps in the sand to illustrate his wanderings, and nearly every primitive tribe to-day makes maps to show routes to hunting-grounds, animal paths, fisheries, fords, etc. They know as well as we do that maps are practically a human necessity; but we know further that a good map often places before our eyes an amount of accurate geographical information that might take many months to dig out of books. We may cite a map of Africa, now over twenty years old, the largest of that continent produced up to 1890. Hermann Habenicht, the compiler, ransacked the literature of African exploration to find what each traveler wrote about the nature of the regions along his route; and the map showed these routes, and marked along them the forest, grassy, sandy, or tillable stretches, the water resources, native settlements, and much other information gleaned by pioneer explorers. The map was a time-saver for students, a fine epitome of some phases of the work done by many men over a long series of years. The leading geographers use the perfected map of to-day as much as they do books, and often more. Dr. Hermann Wagner, for example, has said that maps were his largest dependence in the production of his great *Lehrbuch der Geographie.*

But though map-making is very old, the kinds of maps most useful now have not very long been made. The atlases of a century ago did not contain a tithe of the information now expressed on atlas-sheets. Two generations ago the maps used in European schools gave little more than a few geographical outlines, such as coasts, political boundaries, rivers, and place names; sometimes a few scratches to represent mountains, but not always. It was only sixty-three years ago that Emil Sydow published in Germany the first edition of his school atlas, in which he introduced the revolutionary idea that school maps should tell children something more of geography than the positions of coasts, waters, towns, and boundaries. Maps should picture as well the mountains, valleys, and plains. Cartographic expression should be given to the land forms, and maps should help the teacher to show what the surface of the earth is really like.

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* This is part of a paper printed in *Harper's Magazine*, January, 1912. It is here reprinted by the courtesy of Harper & Brothers.

This fundamental idea has ever since been steadily developing. Map symbolism has wonderfully grown, till it is to-day fully adequate for the graphic expression of a large variety of facts; and, best of all, the European map-makers, by their use of contours of elevation, hachures, colors, and light and shade effects, have so perfected methods of showing the diverse forms of the earth's surface that even on a small-scale map of the Swiss Alps, for example, we may see before us the wonderful complex of high mountains, deep valleys, snow-fields, and glaciers. We may see the birth-place of the Rhine, whose glacial brooklets issue from an ice mass high up on the slopes; the little lake perched far above the valley in a small depression filled by the melting ice of the great Rhone glacier. These atlas-sheets are small, and nature is large; but the fine art of generalizing land forms has been so perfected by European cartographers that, though a great many details must be omitted, still the essentials of form are preserved, so that he who knows how to read maps may easily find the essential truth in the map picture.

The scientific map, so faithfully depicting the manifold aspects of the earth, has helped us to an interesting discovery. We know now that while the great object of geography is to describe the earth's surface, language alone is insufficient for this purpose. Only in the most general terms can speech draw a picture of the face of the earth. If we go into detail and try in words to give a complete description, the picture is vague and the mind cannot fully grasp it. The geographical description must always be associated with the map picture in order to impress upon the mind a clear and orderly idea of the various phases of the earth's surface.

Naturally, a fine map cannot give its greatest service to the man who does not know how to read it. Unfortunately map-reading is taught very little in our own schools; and the first-class map material that alone supplies the wide range of geographical facts, accurately and clearly expressed for the student's map study, is not often seen in our class-rooms. The result is that as a nation we are not skilful map-readers. Several years ago our government topographic survey completed eight sheets, embracing most of the Catskill Mountain region. Here was an opportunity to use these map-sheets of a bit of our country, embracing considerable variety of topographic form, to show how finely all this information might be generalized on a map-sheet of ordinary atlas size. It would be an object-lesson to our people, most of whom seldom see the mother-maps produced by our Government Survey. It would show the hundred thousand or more summer sojourners who annually visit the Catskills how much and how varied is the information that can be truthfully and clearly expressed on a small-scale atlas-sheet.

The American Geographical Society decided to have such a map made by one of the most famous map-houses of Germany. It was sold at cost price, just to demonstrate what beautiful and useful maps we shall have of our own country when we are able ourselves to apply the perfected methods of the cartographic art to the production of good, true, small-scale maps, generalized from the large-scale sheets that our government supplies. It is one of the finest maps of any part of our country. But it has made little impression upon the thousands who use Catskill maps, because so many are accustomed to look to a map only for guidance as to the position of towns and the routes leading to them. Here is a map not limited by such meager detail, but showing not only what the tourist first asks for, but also the hills, valleys, and level stretches in correct proportions and forms. A little careful attention shows approximately the grade of the roads and helps the consultant to figure out how far he can drive and get back to dinner. But though every feature of this beautiful map picture is sharply legible and full of meaning to him who can read a good map, it is to many persons overcrowded and bewildering. It gives them something of the impression that most of us have if we look at a page of Burmese print. How can such a jumble of funny-looking characters mean anything? We cannot read them, that's all.

If we Americans had been taught in school to appreciate and read the best maps, we should not be content with picture maps illustrating theaters of war, as, for example, the map of the strait in which Admiral Togo defeated the Russian fleet, with every war-ship, according to the map scale, at least fifty miles long.

The statement above, that the Catskill map is based upon sheets of our topographic survey, illustrates the two great classes of maps. Topographic surveys originated in Europe, and were meant especially to serve military purposes. It is very important in military operations to know the forms of the land, for as hostile armies approach each other each commander seeks to establish his forces in the most advantageous position for battle. So every important state in Europe organized topographic surveys, and methods were devised for surveying and establishing the elevation and forms of land surfaces. These methods, in time, were highly perfected, all governments use them to-day, and the resulting map-sheets give a close approximation to the actual forms of the earth's surface. We may thank this military impulse for serving so well the highest interests of geography, for these topographic sheets are now the basis of all our most accurate mapping. These detailed maps are, of course, on a large scale, and if well done they show as completely as possible the various features of the small area each includes.

It is different with the small or generalized maps such as the Catskill sheet, on which the great public chiefly depends. If they are maps of high quality they must be based upon the topographic-survey sheets as far as the territory they cover has been topographically mapped. It is interesting to note that while the basis of the generalized map is the topographic map, that of the topographic map is the ground itself. The greatest difficulties of scientific map-making lie in the generalization of these small or atlas sheets. When they show the whole world, or large parts of the earth, very little detail can be given; and in the making of all of these maps the decision of many questions, such as what to use and what to omit or how to generalize without sacrificing all characteristic essence, call for the highest qualities of scientific judgment and technical skill. This fine art of map generalization has been highly developed in most European countries, but as yet it has received little attention from our own map-makers.

Where no topographic surveys have been made the generalized map shows, in white, regions of which we have no knowledge. The delineation of partly known regions is controlled by critical use of all the available data. Accuracy in this case cannot be attained, but such knowledge as we have must be recorded; and it is even permissible to make some deductions as to the geographical features of the unknown if made by those whose theories are worth attention, and recorded on the map not as fact, but as tentative suggestion. Something of this sort has been done on the colored contour map of the United States published by our Geological Survey and showing various elevations of the surface. A large part of this great area has not yet been topographically surveyed, and many of the contours of elevation on the map are therefore tentative; but all considerations have been taken into account to fix the probable value of the contours, and very likely they are not far out of the way.

The effect of increased knowledge is usually to enlarge the scale of generalized maps. Twenty years ago all that was known of the geography of German East Africa might clearly be recorded on a small part of an average atlas-sheet. But hundreds of important geographical facts, such, for example, as the distribution of mineral locations, have since been discovered, with the result that no map of very small scale can now record the information at hand concerning this German colony.

Generalized maps of most European countries on a comparatively large scale are now common, and not a few of them are superb examples of map-making, in which scientific treatment of all geographical phenomena is combined with artistic presentation of the facts. Such maps are a source of great pleasure to the advanced student of geography. Thoroughly based on the principles of scientific cartography, they are works of art as well. One of the most conspicuous among them is Vogel's famous map of Germany in twenty-seven sheets. It cannot embrace all the detail of the topographic sheets, but every fact essential to most map-readers is there. Geographers always love to travel with a fine map in their hands, even when more or less familiar with the regions through which they are passing. The late Professor von Richthofen, of Berlin, said that he never made a railroad journey in Germany without Vogel's map before him. The Germans have devised a new railroad folder which is a delight to all who love to study good maps. It consists of sections of the Vogel map, showing the country for a considerable distance on both sides of all the important routes of travel in Germany. Crossing a little stream, you can see at a glance where it rises, to what larger stream it is tributary, and whether it is likely to be of industrial importance. Passing through the mountains, you can tell what lies beyond the range of vision from the car-window. This is a pastime and also a pleasant way of increasing one's geographical knowledge.

The use of color on maps has now been reduced by the best map-makers to a logical system. Not very long ago we saw on our own maps of the United States each State differentiated from those around it by a covering of color. A tint along the boundaries would have answered every purpose and left opportunity to use colors throughout the sheet as part of the scheme of symbols. Many map colors are now copied directly from nature, and often those selected are particularly appropriate, as, for example, the common use of blues for rainfall maps, the deepening blues of the sea as depths increase, the deepening buffs and browns as the heights of the land augment, the yellow tints for arid and sandy regions, and greens largely used on maps dealing with plant geography. The map-makers of the leading nations are approaching one another more and more nearly in their use of map colors; and for public convenience it is hoped that some day we shall see a uniform system of colors in all map symbolism. Such questions as these are sometimes settled by scientific bodies, as was the case when the Geological Congress at Bologna, in 1881, selected the colors to be applied to the International Geological Map of Europe.

A lesson we have yet to learn at home is that a good map cannot be made in a hurry. Most orders received by our map-making houses are accompanied by demands to hasten the work. The fact is that, even if a map is drawn with the utmost deliberation, errors will creep in. There is no such thing as a perfect map. A wrong stroke of the brush or pen, the slightest carelessness, may vitiate the delineation of the fact to be expressed. What possibility is there that a careful, truthful map may be produced when the demand from the map trade for high speed in performance is so pressing that craftsmen have actually been paid higher wages for manual dexterity than for competency to make a really good map? If many of our commercial map products are of low grade, it is due not only to poor technical and mechanical equipment, but also to the clamorous and incessant pressure of the man who wants the plates. The technical requirements of a good modern map are very great. In Germany a single map-sheet is often in course of preparation for many months. In the British Ordnance Survey the utmost that is expected of some of the workmen is the completion of a square inch of map-work in a day. None of the important map firms of Germany will accept a hurry order. The day is coming when our map-makers will not be compelled, at fever heat, to run a race against time.

The topographic survey-sheets of our Geological Survey and the charts of our Coast and Geodetic Survey are unexcelled by those of any other nation. In other words, we hold our own in the production of base or mother maps. But we fall short in the quality of our generalized or atlas maps. The making of such maps is the highest cartographic test, for they require the most talent and attainment. As the topographer makes his map-sketch in the field, he is producing nothing more than a reduced copy of the ground he is mapping. No imagination, no selection or discrimination is allowed.

He has the object before him, and with the appliances and methods provided he must produce faithfully the facts of nature. But the man who makes a generalized map relies not merely on objective facts, but he must eliminate all the lesser facts and interpret the others in such a manner that in outline and aspect they will be true to nature, though stripped of many of their characteristics. The faculty of doing this in a superior manner is inborn. Cultivation alone will not give it.

But we have not advanced so far in the art of map generalization as to have raised and trained a body of art-cartographers who possess this talent. We have not provided the facilities for training young men for this cartographic mission. The result is that nearly all of the European countries and even Japan are now producing better general atlases than are published in our country. It is not the fault of our few map houses that their products have not reached higher standards of excellence. Good maps cost more than poor ones; and as our system of geographical education has not, on the whole, familiarized students with high-grade maps, they lack appreciation, and there is little demand for them. In many European universities, students of geography are drilled both in the technical and the logical aspects of cartography; but our facilities are still inadequate for instruction in map logic and in the technical features of map production. Many of our maps are more pleasing in appearance than they were twenty years ago, but a map may be made more agreeable to the eye without adding to its scientific value; all our map students agree that in this greatest essential there is room for much improvement.

This situation will not last. Twenty-five years ago the standard of map-making in Great Britain was scarcely higher than it is in our country to-day. But in the course of years the influence of the geographical societies and of the universities in which chairs of Geography had been established brought about some public demand for better quality in maps; and this campaign of map criticism and of stimulation to raise the standard helped conspicuously to bring about a marked improvement in the map products of that kingdom.

An illustration may be given here of the fact that the demand for better maps is growing in our country. Two years ago one of our geographical societies formed a collection of many of the best wall maps and atlases used in several European countries. The collection has been loaned to about twenty universities, colleges, and normal schools, has traveled from the Atlantic to the Pacific, and has engagements for a year to come. The question of map improvement is becoming a live one; and we may expect that the one-millionth map of the world, in whose production all of the great map-making nations have a part, illustrating, as it will, the best phases of the cartographic art, will be potent in its influence upon our general map products.

THE SOCIETY'S TRANSCONTINENTAL EXCURSION

To celebrate the sixtieth anniversary of its founding, and the first of the occupation of the new building which has been presented to it, the American Geographical Society of New York has planned a Transcontinental Excursion which is to be managed and conducted by Professor William Morris Davis of Harvard University. The Excursion will start from New York about August 15 and will end at New York about October 15, 1912. The extreme points included in the proposed route are Seattle (and if possible San Francisco) on the Pacific coast, the Grand Canyon of the Colorado River in northern Arizona, and Chattanooga in eastern Tennessee. Many distinguished geographers of Europe, delegated by European geographical societies, will take part in the excursion, and the occasion will afford them abundant opportunity to observe interesting phases of the geography of our country. The route has been planned with the design to bring into view many aspects of the land, from physiography to economic geography. Various phases of geographical science will be represented by American members of the excursion, who will, as far as possible, act as guides for the European visitors.

The provisional list of the foreign delegates thus far received, and the geographical societies which they represent, are as follows:

AUSTRIA. *k. k. Geographische Gesellschaft, Vienna.* Dr. EDUARD BRÜCKNER, Professor of Geography at the University of Vienna; Dr. FRITZ MACHATSCHEK, Privatdozent of Geography at the University of Vienna; Dr. EUGEN OBERHUMMER, Professor of Geography at the University of Vienna.

BELGIUM. *Société Royale Belge de Géographie, Brussels.* GEORGES LECOINTE, Scientific Director at the Royal Belgian Observatory, Uccle.

DENMARK. *Kongelige Danske Geografiske Selskab, Copenhagen.* Professor OLE OLUFSEN, Secretary of the Royal Danish Geographical Society, Copenhagen.

FRANCE. *Société de Géographie, Paris.* Dr. GUILLAUME GRANDIDIER, Vice-President, Commission Centrale de la Société de Géographie, Paris; EMMANUEL DE MARGERIE, Vice-President, Section of Historical and Descriptive Geography